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Research Note

NORTHERN ROCKY MOUNTAIN
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THE PROFIT IN PRUNING

WESTERN WHITE AND PONDEROSA PINE

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Foresters in the Northern Rockies long have regarded artificial pruning of trees to produce knot-free lumber as a desirable forest culture measure. Declining supplies of old-growth saw timber point to difficulty in getting substantial quantities of clear lumber in the future. The wide spread in value between Selects and Common lumber suggests that production of clear lumber by pruning may be profitable. Although it seemed clear that increases in lumber value would exceed the costs of pruning, no data existed for Northern Rocky Mountain tree species to indicate the amount of gain. As a consequence, the study reported here undertook to answer the question of how much profit there is in pruning western white pine and ponderosa pine.

Method of Comparing Pruned and Unpruned Butt Logs

The study was made by comparing the yield and value of standard lumber grades produced from the butt logs of unpruned trees with those that could be produced from pruned trees. The basic idea was that if two equal-sized butt logs, one being from a pruned tree, were sawed in the same way on the same mill, the difference in lumber values between the logs would represent the gross gain from pruning.

The costs of pruning were deducted from gross pruning gain to arrive at the increase in lumber values from pruning. Pruning a tree to a height of 17 feet in three successive operations requires about 12 minutes. This is the chief cost. Using $1.48\frac{1}{2}$ per hour for labor, plus 25 percent for tools, transportation, and supervision, the total cost for pruning was estimated to be $0.37 per tree.

A mill study 1/ of butt logs furnished actual lumber grade recoveries from unpruned trees. The comparable yields from pruned trees were estimated from diagrams of the small ends of logs in which 4, 6, and 8-inch knotty core diameters were assumed. In squaring out these central, knotty cores in the log-end diagrams, an inch was added on the radius to allow for pitch pockets and irregular grain in the healing of the wounds. Using a 5/32-inch saw kerf, ends of boards were then drafted on the diagrams and graded 2/.

Several assumptions in the study tend to make the results conservative. The inch-on-the-radius allowance for wound healing is probably generous. In estimating the grade of lumber from pruned logs, C Select was adopted as the upper quality limit. No premiums were considered on extra wide boards and all "sawing" was presumed to be for 4/4 lumber. Log taper, taper sawing, and possible use of logs for veneer were disregarded. Also, no allowance was made for the probability that in the future clear lumber will command a greater differential value than at present.

Although the calculations are believed to be generally conservative, pruning investments also involve elements of risk. Rot may enter through branch wounds. Removal of limbs may result in sunscald. Sometimes trees die if too heavily pruned 3/. Heavy pruning causes some reduction in growth rate. Pruned trees may be killed or irrepairably damaged by natural agents, such as wind, glaze, and porcupines. Information is not available to evaluate these and perhaps other risks. For purposes of this study, they were assumed to be over-weighed by the conservative assumptions.

Diameter growth rates used in the study represent the usual growth of vigorous, dominant, or rather open-grown trees, on average and better sites in the Northern Rockies. These are the best types of trees to prune artificially. If trees on poorer sites or which are overtopped or crowded are pruned, smaller returns in volume and value should be expected.

1/ Bradner, M. and S. V. Fullaway, 1927. Size of Timber, Amount of Defect--Important Factors in Lumbering. The Timberman, Vol. 29, No. 2.

2/ The lumber grades were estimated by I. V. Anderson, Chief, Forest Utilization Service, Northern Rocky Mountain Forest and Range Experiment Station, Missoula, Montana.

3/ Helmers, Austin E. Effect of Pruning on Growth of Western White Pine. Jour. Forestry 44:673-676. September, 1946.

Results

Table 1.--The increase in lumber value from pruning 16-foot butt logs.

D.I.B. small end of log	Pruned to approximate a cylindrical --		
	4" core	6" core	8" core
Inches	Percent	Percent	Percent
Western White Pine			
8	0	0	0
10	33	0	0
12	47	28	0
16	42	31	13
20	40	32	25
24	40	35	31
Ponderosa Pine			
8	0	0	0
10	31	0	0
12	68	43	0
16	78	60	37
20	77	67	56
24	75	68	64

Comparison based upon September 19-24, 1949, lumber prices.

The greatest increase in the quality of lumber comes when pruning confines the knots to the smallest possible core (see Fig. 1). Table 1 shows that if western white pine and ponderosa pine are pruned to a 4-inch cylindrical, knotty core, the butt logs will be worth about one third more when they reach 10 inches d.i.b. small end. When the butt logs reach 12 inches d.i.b. small end, those from pruned white pine become about one half again as valuable as those from unpruned white pine, and ponderosa pine logs increase in value by about two thirds. As might be expected, the gain from artificial pruning tapers off in the larger sized trees because of the natural tendency of larger trees to prune themselves.

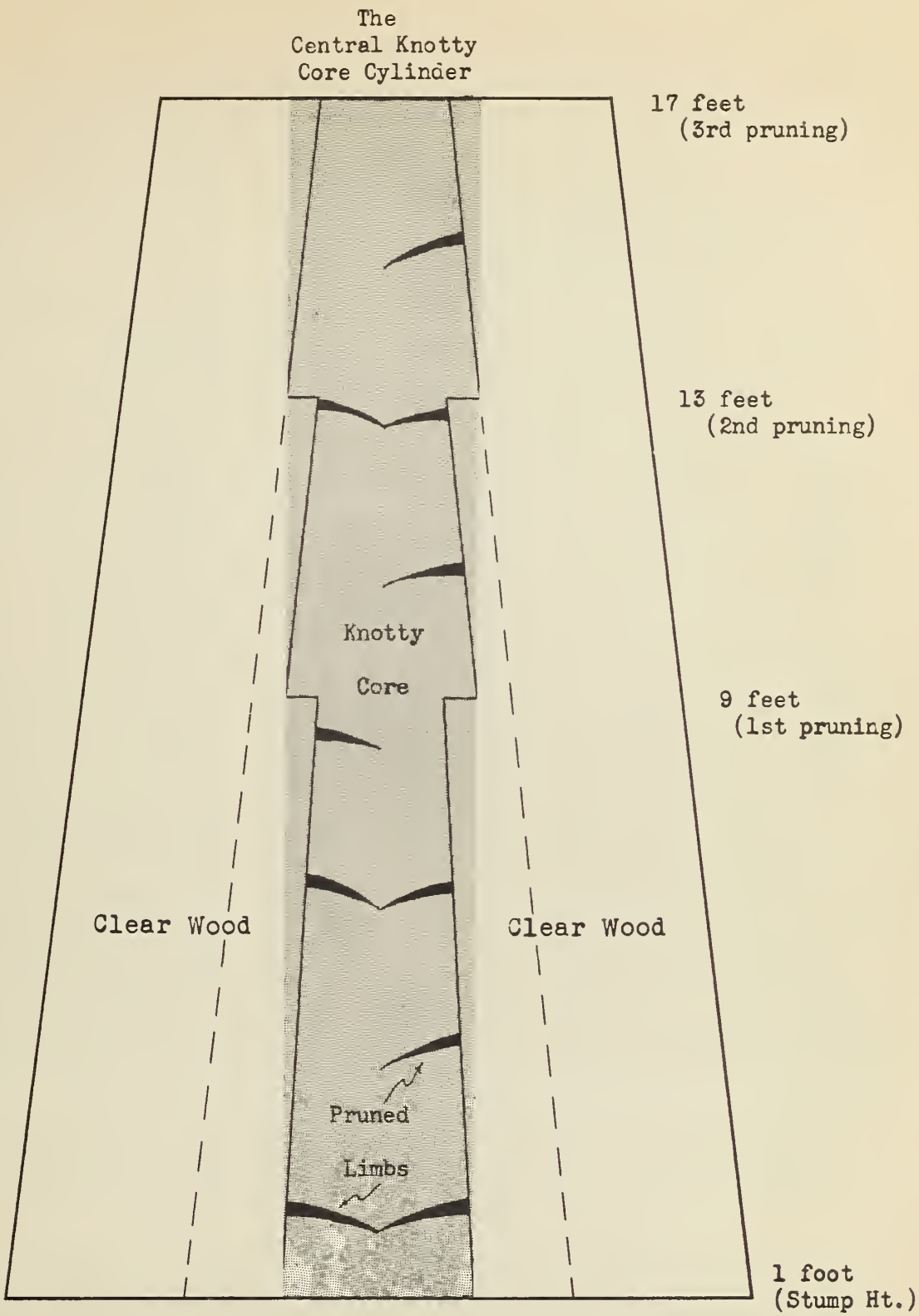

Figure 1. - Butt Log Pruned To 17 Feet

This diagram illustrates the desirability of 3-stage pruning. The knotty core is confined to a cylinder represented by the shaded area. If the first pruning had been deferred until the entire 17 feet could be pruned in a single operation, the knotty core would have been undesirably large and tapared, as indicated by the dotted line.

Table 2.--The increase in lumber values 1/ for pruned butt logs, after deducting cost of pruning.

D.I.B. small end of butt log	D.B.H.	Age	Additional value per MBM when trees are pruned at a.....		
			4" core	6" core	8" core
Inches	Inches	Years	Dollars	Dollars	Dollars
- - - - - - - - - - - - - - - - Western White Pine - - - - - - - - - - - - - - - -					
8	11	53	0.00	0.00	0.00
10	13	65	29.56	0.00	0.00
12	16	80	42.51	20.45	0.00
16	21	115	48.56	30.09	15.86
20	27	160	51.96	38.64	30.73
- - - - - - - - - - - - - - - - Ponderosa Pine - - - - - - - - - - - - - - - -					
8	11	60	0.00	0.00	0.00
10	13	75	23.84	0.00	0.00
12	16	100	43.28	22.25	0.00
16	21	140	53.72	34.91	22.07
20	27	190	60.70	48.94	41.56

1/ Based upon September 19-24, 1949, lumber prices.

Pruning of both of the western pines appears to be a profitable forest practice. For example, table 2 shows that a pruned butt log of white pine, having a 4-inch knotty core and harvested at 21 inches d.b.h., will yield $48.56 more per thousand after pruning costs than an identical unpruned log. In ponderosa pine, the same comparison shows the increase in net profit by pruning to be $53.72 more per thousand. However, the figures in table 2 do not apply to the entire tree nor to the whole stand in pruning versus non-pruning comparisons. Interest on the cost of pruning is not included in table 2. Instead, the rate of interest earned on the pruning investment in producing the increased lumber values is shown in table 3.

Ponderosa pine prunes itself naturally better than white pine. However, ponderosa pine shows the larger gain from artificial pruning. This larger gain is due to the greater differential between pruned and unpruned mill-run lumber values in ponderosa pine even though white pine lumber is higher priced.

The effect of knotty core size shows up strikingly in table 2. Trees with 4-inch knotty cores begin to increase significantly in value at d.b.h. 13 inches, but those with 8-inch cores show no gain until they become 21 inches d.b.h. If the knotty core is small, the tree does not have to increase greatly in size before it becomes possible to saw clear boards from around the core. However, if the knotty core is large, a wide band of increment must be laid on before a high proportion of clear lumber can be recovered. A 4-inch knotty core means that a tree received the first of its prunings when it was about 4 inches d.b.h., and an 8-inch core means that a tree was first pruned when it was about 8 inches d.b.h. Pruning larger trees, say 10 or 12 inches d.b.h., evidently will not be good business. Such trees would take too long to produce clear boards in significant quantities.

Table 3.—Compound interest earned on a pruning investment. 1/

D.I.B. small end of log	D.B.H.	Age	Pruned to approximate a cylindrical—		
			4" core	6" core	8" core
Inches	Inches	Years	Percent	Percent	Percent
		Western White Pine			
8	11	55	0.0	0.0	0.0
10	13	65	4.0	0.0	0.0
12	16	80	4.4	3.8	0.0
16	21	115	3.6	3.4	3.0
20	27	160	2.5	2.5	2.8
		Ponderosa Pine			
8	11	60	0.0	0.0	0.0
10	13	75	3.2	0.0	0.0
12	16	100	3.5	3.1	0.0
16	21	140	3.1	3.0	2.7
20	27	190	2.5	2.5	2.5

1/ These interest rates express the dollar earnings per MBM, as shown in table 2, in relation to the pruning investment per MBM-of-harvested-logs.

Table 3 shows that the greatest rate of earning on the pruning investment occurs on trees of intermediate sizes. In larger trees, the lumber value gain of the pruned logs does not keep pace with the accumulating compound interest on the pruning investment, accounting for the decline in earning rate in later years. It does not necessarily follow that the pruned trees should be cut at the culmination of the compound interest return on the pruning investment. Pruning does tend to shorten rotations, but there are many other costs and factors of forest management that must be considered in setting the most profitable and desirable harvest age.